J. Field Ornithol., 65(4):543–550

# DIFFERENTIAL BAND WEAR FOR MALE AND FEMALE LAUGHING GULLS

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Abstract.—Mass loss and wear of sizes 4A and 5 bands on male and female Laughing Gulls (*Larus atricilla*) collected at John F. Kennedy International Airport, New York in 1991–1993 were analyzed. For band size 4A, there were significant differences in band mass between sexes for ages 2–6 yr. Bands on females lost a mean of 51 mg of mass per year (7.6% of original mass), greater than the 46 mg (6.8%) per year for bands on males. At age 6, size 4A bands on females averaged 2.43 numerals (of eight) showing edge wear compared to 0.68 numerals for males. In contrast to the findings for band size 4A on gulls 2–6 yr old, no significant differences in band mass or numeral wear were noted between sexes for band size 5 on gulls 7–8 yr old. The rate of mass loss for size 5 bands for years 6–8 (49 mg per year) is intermediate to that for size 4A bands on males and females for years 2–6. At age 8, size 5 bands averaged 45.0% of their original mass. The significantly smaller diameters of female tarsi compared to males probably allowed size 4A bands to move and abrade more freely, causing the difference in band wear between Laughing Gull sexes. That no differences in wear were detected between sexes in size 5 bands might be related to these larger diameter bands allowing for equal movement on the tarsi of males and females. Extensive band loss for Laughing Gulls banded as chicks should begin at about age 9 or 10. Females wearing size 4A bands should begin losing bands 1 or 2 yr earlier than males.

## DIFERENCIAS EN EL DESGASTE DE ANILLAS ENTRE MACHOS Y HEMBRAS DE *LARUS ATRICILLA*

Sinopsis—Se analizó la pérdida en masa y el desgaste de anillas tamaños 4A y 5 provenientes de *Larus atricilla* obtenidas en el Aeropuerto Internacional John F. Kennedy en Nueva York entre el 1991 y el 1993. Se hallaron diferencias significativas en la masa de las anillas 4A según el sexo del ave para las edades de 2 y 6 años. Mientras que anillas colocadas en hembras perdieron un promedio de 51 mg de masa anual (7.6%) de la masa original, las anillas en los machos sólo perdieron 46 mg (6.8%) anuales. A los 6 años, anillas tamaño 4A colocadas en hembras promediaron 2.43 números (de un total de ocho) con desgaste en los lados, mientras que el desgaste en bandas en los machos fue en 0.68 números. En contraste a lo hallado en las anillas 4A en gaviotas de 2 a 6 años, no se encontraron diferencias significativas en la masa de las anillas o en el desgaste numérico según el sexo que tenía la anilla tamaño 5 en gaviotas de 7 a 8 años. La razón de pérdida de masa para anillas tamaño 5 en gaviotas de 6 a 8 años (49 mg anuales) esté entre las razones de desgaste de anillas tamaño 4A en ambos sexos de entre 2 y 6 años. A los 8 años, las anillas tamaño 5 promediaron 45.0% de su masa original. Los diámetros de tarsos de las hembras son significativamente más pequeños que los de los machos, lo que probablemente permitió que las anillas de tamaño 4A se movieran y desgastaran más pobremente, acusando las diferencias en desgaste de anillas entre los sexos de *Larus atricilla*. La falta de diferencia en desgaste de anillas tamaño 5 notada entre los sexos puede estar relacionada a que el diémetro mayor de éstas permite igual movimiento en el tarso de machos y hembras. Se espera que la pérdida excesiva de banda en *Larus atricilla* anilladas como pichones comience a los 9 o 10 años. Hembras usando anillas tamaño 4A deberían empezar a perder anillas uno a dos años antes que los machos.

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The loss of bands due to wear and corrosion has been documented for several avian species, especially larids (e.g., Kadlec 1975, Kadlec and Drury 1968). Few data exist on rates of wear (Ludwig 1967, 1981), however, particularly rates of wear analyzed by sex. No published data on band wear exists for Laughing Gulls (*Larus atricilla*).

Although male gulls are typically larger than females (adult male mass averages 15–26% more than that of females in 11 species [Dunning 1993]), most gulls are banded as chicks with no effort made to adjust band size for sex. Mills (1972) speculated that a higher loss of bands detected in female Red-billed Gulls (*L. novaehollandiae*) compared to males might be related to the smaller legs of females allowing greater movement and wear of bands. In 1991–1993, we obtained bands from known-age adult Laughing Gulls to examine the annual rate of wear by sex.

## METHODS

Laughing Gulls flying over John F. Kennedy International Airport (JFKIA), New York (40°38′N, 73°47′W), were shot from 20 May to 8 Aug. 1991–1993 as part of a management program related to airport safety (Dolbeer et al. 1993). Most of these gulls were adults from a nesting colony on islands in Jamaica Bay immediately south of the airport. All retrieved gulls were examined for bands. Bands were removed and stored for later analyses after recording the numbers and collection dates. In 1992 and 1993, the sex of each banded gull was determined by autopsy. In 1992, the anterior-posterior diameter of the tarsus at the midpoint and the tarsus length also were measured with calipers to the nearest 0.01 mm on the left leg of each bird and the mass of each bird was measured to the nearest 1 g. Banding data (date, location and age) for each gull were provided by the U.S. Fish and Wildlife Service, Office of Migratory Bird Management (OMBM), Patuxent, Maryland. Only those gulls banded as chicks with standard size 4A or 5 aluminum butt-end bands were used in the analysis.

Bands were soaked overnight in a mild detergent solution and cleaned with a soft toothbrush. Bands with missing metal such as caused by banding pliers or shotgun pellets were excluded. After drying, each band was weighed to the nearest 1 mg. Band height was measured with calipers to the nearest 0.01 mm at the hyphen following the prefix numerals. Band thickness was measured to the nearest 0.01 mm with a micrometer at a point halfway between the hyphen and the letters above the hyphen. Bands were designated as either showing or not showing corrosion (pitting or other degradation of the metal surface). The number of individual numerals on a band showing wear from the edge (where any part of the numeral was missing) was recorded. A set of 10 archived bands supplied by the OMBM also was measured for each of the two band sizes.

Gull body measurements (body mass and tarsus lengths) were compared between males and females using *t*-tests. Band measurements were compared among years and between sexes by 2-way ANOVA (SPSS Inc.

TABLE 1. Sample sizes and masses (mg) of sizes 4A and 5 aluminum bands recovered at John F. Kennedy International Airport, New York, in 1991–1993 from Laughing Gulls banded as chicks.

| Band age (yr) | Band size 4A[a] | | | | | | Band size 5[b] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | | | Female | | | Male | | | Female | | |
| | *n* | $\bar{x}$ | SD | *n* | $\bar{x}$ | SD | *n* | $\bar{x}$ | SD | *n* | $\bar{x}$ | SD |
| 0[c] | 10 | 673 | 2 | | — | | 10 | 711 | 2 | | — | |
| 2 | 10 | 566 | 15 | 7 | 544 | 20 | | — | | | — | |
| 3 | 42 | 520 | 28 | 19 | 518 | 23 | | — | | | — | |
| 4 | 31 | 473 | 34 | 17 | 447 | 29 | | — | | | — | |
| 5 | 29 | 433 | 52 | 11 | 412 | 42 | | — | | | — | |
| 6 | 19 | 392 | 27 | 7 | 368 | 37 | | — | | | — | |
| 7 | | — | | | — | | 13 | 364 | 56 | 7 | 361 | 49 |
| 8 | | — | | | — | | 8 | 306 | 68 | 4 | 366 | 32 |

[a] There were differences in band mass among ages ($F = 119.1$; 4, 182 df, $P < 0.01$) and between sexes ($F = 10.2$; 1, 182 df, $P < 0.01$) for ages 2–6. There was no sex-year interaction ($F = 1.0$; 4, 182 df, $P = 0.42$).

[b] There were no differences in band mass between ages ($F = 3.3$; 1, 28 df, $P = 0.08$) or between sexes ($F = 1.0$; 1, 28 df, $P = 0.33$) for ages 7 and 8.

[c] Archived sizes 4A and 5 bands provided by U.S. Fish and Wildlife Service (disregard sex classification).

1990). Linear regression was used to determine and compare rates of mass loss for bands on males and females over years.

## RESULTS

*Banded population.*—Of 525 banded Laughing Gulls recovered at JFKIA in 1991–1993, 522 had been banded as chicks and, thus, were of known age. Ninety-eight percent (511) of these birds had been banded by L. R. Pharo at Barnegat Light, New Jersey, 106 km from JFKIA. Birds <1–12 yr old were recovered but sample sizes were sufficient only for ages 2–6 for band size 4A (≥7 bands per age-sex category) and ages 7–8 for band size 5 (≥4 bands per age-sex category) to make comparisons between sexes (Table 1). All other age categories had a sample size of ≤2 for one sex. Size 5 bands were used from 1980–1985 and size 4A bands thereafter.

TABLE 2. Measurements of male and female Laughing Gulls (≥2 yr old) from John F. Kennedy International Airport, New York, May–August 1992.

| Measurement[a] | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | *n* | $\bar{x}$ | SD | *n* | $\bar{x}$ | SD |
| Body mass (g) | 142 | 346 | 25 | 58 | 321 | 33 |
| Tarsus width (mm) | 141 | 5.74 | 0.33 | 60 | 5.44 | 0.33 |
| Tarsus length (mm) | 142 | 45.27 | 1.74 | 60 | 42.67 | 1.92 |

[a] Means are different ($P < 0.01$) between sexes for all measurements ($t \geq 6.05$, 198–200 df).

The mean tarsus diameter, tarsus length and body mass of female Laughing Gulls were all 6–8% less ($P < 0.01$) than the respective means for males (Table 2).

*Size 4A bands.*—There were differences ($P < 0.01$) in band mass among ages 2–6 and between sexes for these ages (Table 1). There was no interaction by sex and age ($P = 0.42$) for band mass. Overall, bands on females lost a mean of 51 mg of mass per year (7.6% of original mass), greater ($P < 0.01$) than the 46 mg (6.8%) per year for bands on males (Fig. 1). After 6 yr, size 4A bands on females averaged 54.7% of their original mass compared to 58.2% for males.

Although mean band height, mean band thickness and incidence of corrosion all changed significantly ($P < 0.01$) with age ($F \geq 3.96$; 4, 182 df), these characteristics did not differ ($P \geq 0.15$) between sexes ($F \leq 2.15$; 1, 182 df) (Fig. 2). Numeral wear, however, first evident in age 5 birds, was greater ($P = 0.02$) for females than males ($F = 5.30$; 1, 182 df). At age 6, bands on females averaged 2.43 numerals (of eight) showing edge wear compared to 0.68 numerals for males (Fig. 3).

*Size 5 bands.*—In contrast to the findings for band size 4A on gulls 2–6 yr old, no differences ($P \geq 0.33$) in band mass (Table 1) or numeral wear (Fig. 3) were noted between sexes for band size 5 on gulls 7–8 yr old ($F \leq 0.99$; 1, 28 df). Also, no differences ($P \geq 0.52$) were noted between sexes in mean band height, mean band thickness or incidence of corrosion ($F \leq 0.43$; 1, 28 df) (Fig. 2). If bands from both sexes and unknown-sex birds are combined, age classes 6–8 have sufficient samples (≥16 bands) to examine wear as a function of age. The rate of mass loss for size 5 bands for ages 6–8 (49 mg per year) is similar to that for size 4A bands for ages 2–6, being intermediate to that for males (51 mg) and females (46 mg) (Fig. 1). At age 8, size 5 bands averaged 45.0% of their original mass. Size 5 bands initially averaged 38 mg (5.6%) more mass than size 4A bands (Table 1).

## DISCUSSION

We determined that size 4A bands worn by female Laughing Gulls lost mass at a higher rate than did size 4A bands worn by males. Mills (1972) speculated that sex-differentiated band wear for Red-billed Gulls in New Zealand might be caused by sex-specific differences in activity, habitat use, fecal material or morphometrics. We believe that sexual dimorphism, particularly the significant difference in tarsus diameter, is the most likely explanation. The smaller diameter of female tarsi should allow size 4A bands to move and abrade more freely. In addition, the wider gap between the band and tarsus for females might introduce a greater collection of abrasive materials (e.g., sand) than for males. Ludwig (1981) determined that tighter-fitting size 4A bands lost mass at a lesser rate than did size 5 bands on Caspian Terns (*Sterna caspia*).

The fact that no differences in wear were detected between sexes in size 5 bands might be related to these slightly larger diameter bands (mean inside diameter = 7.94 mm compared to 7.14 mm for size 4A

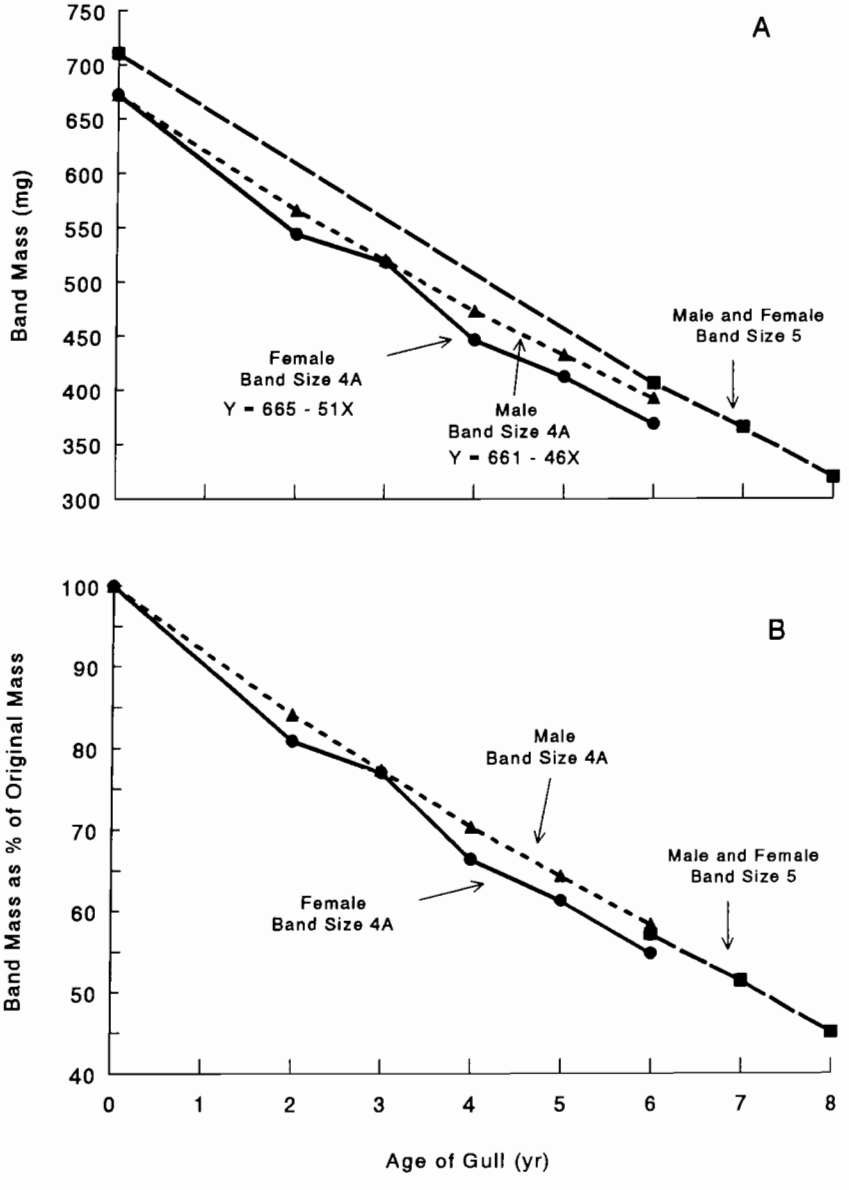
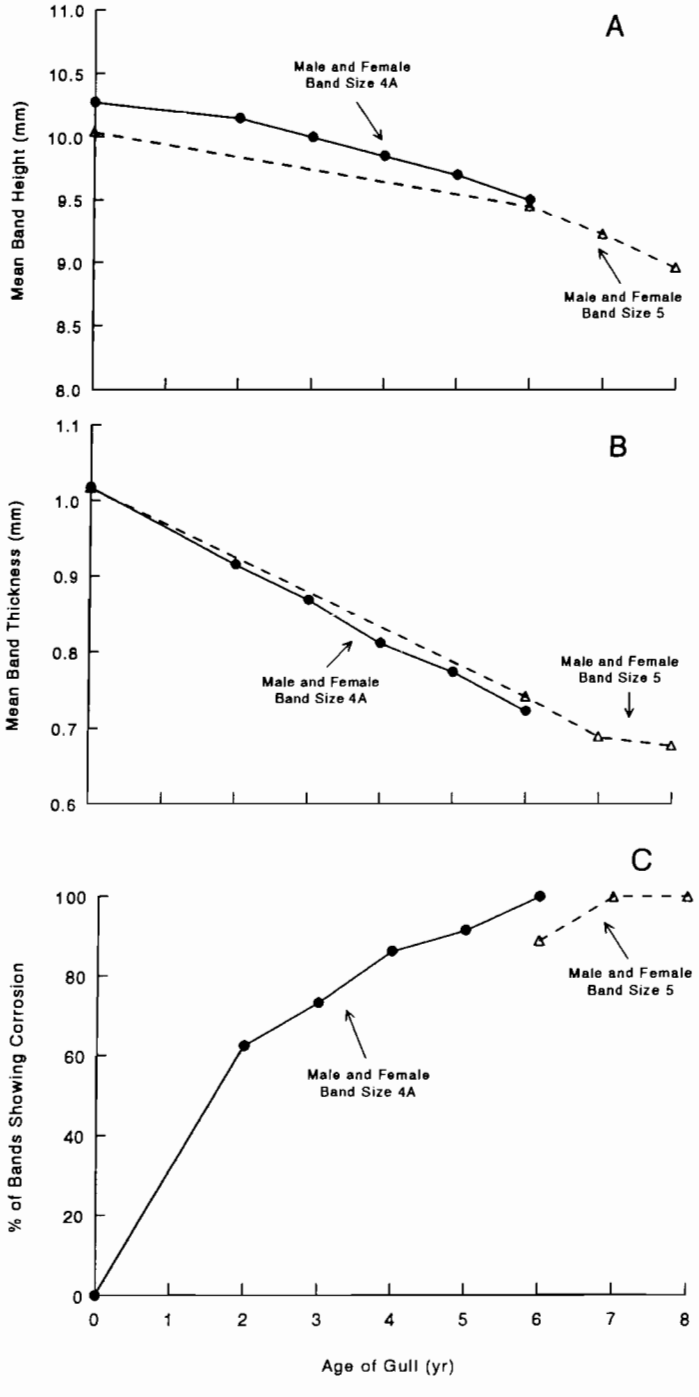



FIGURE 1. Mean band mass (A) and percent of original band mass (B) in relation to age for Laughing Gulls wearing size 4A bands (ages 2–6) and size 5 bands (ages 6–8). The rate of band wear (mass loss) was different ($P < 0.01$) for males and females from ages 2–6.


A
Mean Band Height (mm)
11.0
10.5
10.0
9.5
9.0
8.5
8.0
Male and Female
Band Size 4A
Male and Female
Band Size 5
B
Mean Band Thickness (mm)
1.1
1.0
0.9
0.8
0.7
0.6
Male and Female
Band Size 4A
Male and Female
Band Size 5
C
% of Bands Showing Corrosion
100
80
60
40
20
0
Male and Female
Band Size 5
Male and Female
Band Size 4A
0
1
2
3
4
5
6
7
8
Age of Gull (yr)

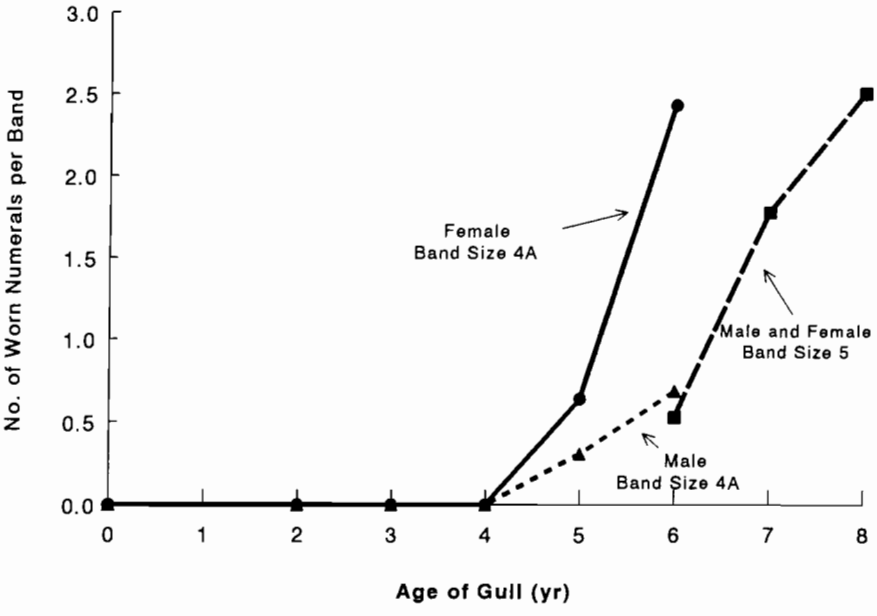



FIGURE 3. Mean number of numerals worn from the edge per band in relation to age for Laughing Gulls wearing size 4A bands (ages 2–6) and size 5 bands (ages 6–8). Numeral wear was different ($P = 0.02$) for male and females for ages 2–6.

bands, Canadian Wildlife Service 1991) allowing equal movement up and down the tarsi of males and females. Another explanation relates to our limitation, because of sample size, to examine sex differences in ages 7 and 8 only, when mean mass loss per band had already reached >50%. Perhaps band loss had already begun for females of these age classes and we examined a biased sample of the least-worn bands. Ludwig (1967) stated that loss of size 5 bands on Ring-billed Gulls (*L. delawarensis*) from the Great Lakes began when mass loss reached about 60% and was complete when mass loss reached about 69%. Regardless of possible sex-related differences in wear and in contrast to Ludwig's (1981) findings for Caspian Terns, we found no evidence that the looser-fitting size 5 bands wore at a more rapid rate than did size 4A bands.

Ludwig (1967) determined an average rate of mass loss for size 5 bands on Ring-billed Gulls to be about 60 mg (8.3%) per year for ages 2–6, which is about 10 mg more (a 20% higher rate) than we estimated for

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FIGURE 2. Mean band height (A), band thickness (B), and incidence of band corrosion (C) in relation to age for Laughing Gulls wearing size 4A bands (ages 2–8) and size 5 bands (ages 6–8). No differences ($P \geq 0.15$) were detected between males and females for these measurements.

sizes 4A or 5 bands on Laughing Gulls. In contrast to these gulls, Ludwig (1981) found band wear of sizes 4A and 5 aluminum bands for Caspian Terns from the Great Lakes to be only about 2.2–3.0% per year. Thus, band wear for Laughing Gulls appears to be intermediate to wear for these two species. Based on Ludwig's (1967) conclusion that loss of size 5 bands occurs when mass loss reaches about 60%, extensive band loss for Laughing Gulls should begin at about age 9 or 10. Females wearing size 4A bands should begin losing bands 1 or 2 yr earlier than males.

## ACKNOWLEDGMENTS

We thank J. L. Bucknall, S. Chevalier, W. H. Homan, R. W. Hosford, S. R. Masone, A. J. Montoney and K. P. Strucker for field assistance. S. K. Ickes and M. R. Rutger took most measurements. D. R. Bystrak provided archived bands and banding data in a timely fashion. The contributions of L. R. Pharo from his sustained banding program in New Jersey are gratefully acknowledged. Funding was provided by the Port Authority of New York and New Jersey.

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Received 28 Feb. 1994; accepted 15 Apr. 1994.